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ASCA Observation of an "X-ray Shadow" in the Galactic Plane

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ABSTRACT

The diffuse X-ray background (DXB) emission near the Galactic plane $(l, b \sim 25.6°, 0.78°)$ has been observed with *ASCA*. The observed region is toward a Galactic molecular cloud which was recently reported to cast a deep X-ray shadow in the 0.5 − 2.0 keV band DXB. The selection of this particular region is intended to provide a constraint on the spatial distribution of the DXB emission along the line of sight: i.e., the molecular cloud is optically thick at <2 keV and so the bulk of the observed soft X-rays *must* originate in the foreground of the cloud, which is at ∼3 kpc from the Sun. In the 0.8 − 9.0 keV band, the observed spectrum is primarily from multiple components of thermal plasmas. We here report a detection of soft X-ray (0.5 − 2 keV) emission from an $\sim 10^7$ K thermal plasma. Comparisons with the *ROSAT* data suggest that this soft X-ray emission is absorbed by $N_H = 1 - 3 \times 10^{21}$ cm^{-2}, which implies a path-length through the soft X-ray emitting regions of $\lesssim$1 kpc from the Sun.

Subject headings: diffuse radiation — Galaxy: structure — ISM: structure — X-rays: ISM

1. INTRODUCTION

The 0.1 − 0.3 keV band diffuse X-ray background (DXB) emission in the Galactic plane has been attributed to the emission from the Local Hot Bubble (LHB): an $\sim 10^6$ K plasma filling an extensive cavity, where absorbing neutral material is difficient, with an average radius of ∼100 pc around the solar system (Cox & Reynolds 1987; Snowden et al. 1998). At >2 keV it has been known that there exists unresolved DXB emission along a thin disk of the plane ($-60° < l < 60°$): the so-called Galactic ridge X-ray emission (GRXE) (Worrall et al. 1982; Warwick et al. 1985).